कृषि पंपिंग पद्धतियों की चूषण लाइनों में उपयोग किए जाने के लिए फुट-वाल्व, पश्च्वाहन वाल्व या नॉन-रिटर्न वाल्व और बोर वाल्व — विशिष्टि

(दूसरा पुनरीक्षण)

Foot-Valves, Reflux Valves or Non-Return Valves and Bore Valves to be Used in Suction Lines of Agricultural Pumping Systems — Specification

(Second Revision)

ICS 23.100.30

November 2022   **Price Group 9**

Pumps Sectional Committee, MED 20

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Pumps Sectional Committee had been approved by the Mechanical Engineering Divisional Council.

This standard was first published in 1984 and subsequently revised in 1986. This standard originally covered only the requirements of foot-valve.

In the first revision, the requirements of reflux and bore valves were added. The foot-valve is fitted at the bottom end of the suction line which is suspended in the well. It has a strainer unit at the bottom portion. The bore valve is also fitted at the bottom end of the suction line which is inserted into the bore pipe of dug-cum-bored well or tubewell. It may or may not have a strainer unit at the bottom. The outside diameter of the slender body of the bore valve is restricted according to the size of the bore/tubewell in which it is to be inserted. The reflux valve is fitted at the top end of the suction line or bore pipe. Alternatively, it may be fitted anywhere in the suction line of which the bottom end is inserted into a bore pipe or tubewell. It has threaded or flanged portions at both ends.

This revision has been taken up to keep pace with the latest technological developments. This revision incorporatesthe following major changes, apart from incorporating the amendments issued to the last version of the standard:

   a)   A reference clause has been added mentioning the latest version of all the referred standards.
   b)   In clause **4.1** obsolete grades of mild steel have been deleted and new grades have been added.

In the revision of this standard, considerable assistance has been obtained from the leading manufacturers and users in this country.

The composition of the committee responsible for the formulation of this standard is given in   Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*).' The number of significant places retained in the rounded-off value should be the same as that of the specified value in this standard.

Indian Standard

FOOT-VALVES, REFLUX VALVES OR NON-RETURN VALVES AND BORE VALVES TO BE USED IN SUCTION LINES OF AGRICULTURAL PUMPING SYSTEMS- SPECIFICATION

(*Second Revision*)

1 SCOPE

This standard specifies the requirements for screwed and flanged foot-valves, reflux valves or non-return valves and bore valves to be used in suction lines of centrifugal pumps for agricultural purposes.

2 REFERENCES

The standards indicated in Annex A, contain provisions which through their reference in this text constitute provisions of this standard. At the time of publication,

the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibilities of applying the most recent editions of the standards in Annex A.

3 DIMENSIONS

The dimensions of the valves shall be as given in Table 1.

3.1 Typical drawings of foot-valve, reflux valve and bore valve are given in Fig. 1 to 3

Table 1 Dimension of Foot-Valves, Reflux Valves, and Bore Valves

(*Clause* 3)

All dimensions in millimeters.

Sl. No.	Nominal Size	Openings in Strainer		Screwed End		Face to Face Dimension (± 2 mm)
		Holes Maximum Diameter	Slots Maximum Width	Minimum Height of Flat End	Minimum Length of Threaded Portion	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	25	6	6	10	15	—
ii)	32	7	7	10	15	—
iii)	40	8	8	10	15	—
iv)	50	10	10	12	15	256
v)	65	12	12	15	20	260
vi)	80	12	12	18	22	274
vii)	100	15	15	22	26	304

| Sl. No. | Nominal Size | Openings in Strainer | | Screwed End | | Face to Face Dimension |
		Holes Maximum Diameter	Slots Maximum Width	Minimum Height of Flat End	Minimum Length of Threaded Portion	(± 2 mm)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
viii)	125	15	15	26	26	338
ix)	150	15	15	26	26	394

NOTES

1 In reflux valves the threaded or flanged connection is provided in place of the strainer unit. Thus, a reflux valve shall have screwed ends or flanged ends at the top and bottom portions. It may be screwed at one end and flanged at one end also. Return valve may have the following alternate end connection:

a) Both ends screwed;
b) Both ends flanged;
c) Bottom end flanged, top-end screwed; and
d) Bottom end screwed, top-end flanged.
e) Dimensions of such screwed/flanged ends shall be as indicated in the table.

2 In the bore valves the top ends shall have screwed ends. The dimensions of screwed ends shall be as indicated above. The outside diameter of the entire bore valve shall be smaller (by more than 5 mm) than the internal diameter of the bore pipe in which it is to be inserted. The bore valve may or may not have strainer.

3 The opening in the strainers may be in the form of holes or slots or a combination of both.

4 Where required, an access window may be provided for carrying out maintenance.

5 The face-to-face dimensions are applicable only for valves, where both ends of the valve are of flanged construction, as shown in Fig. 2B.

4 MATERIALS

4.1 It is recognized that a number of materials of construction are available. A few typical materials are indicated below for the guidance of the manufacturers and the users:

Sl. No.	Component	Material
i)	Housing, seat, and strainer	Cast Iron of Grade FG 150 of IS 210
ii)	Disc and disc plate	a) Cast Iron of Grade FG 150 of IS 210 b) Mild steel conforming to

Sl. No.	Component	Material
		Grade ISH 330S, as mentioned in IS 5986
iii)	Disc face (flap)	a) Vegetable tanned leather a) Natural rubber with or without reinforcement of cotton canvas b) Synthetic rubber with or without reinforcement of cotton canvas
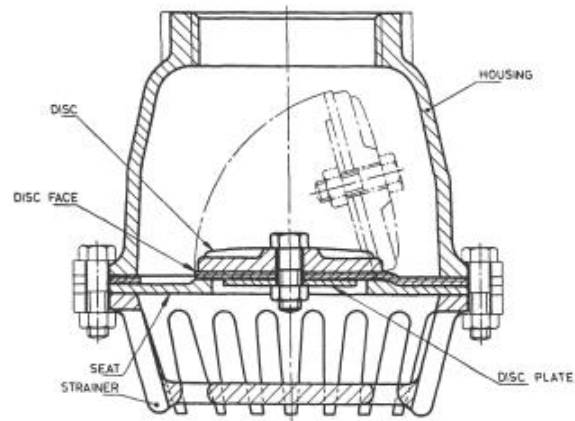
NOTE — The shape of the foot valve has been given only to illustrate the nomenclature and is not intended to limit the design.
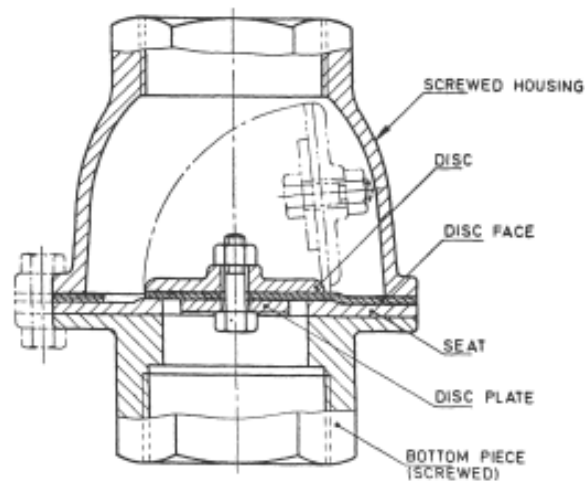
FIG. 1 FOOT-VALVE

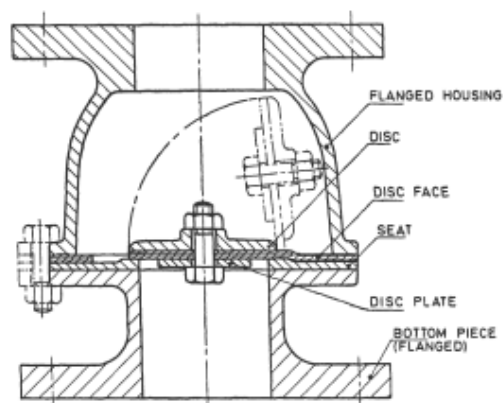FIG. 2A TYPICAL SECTIONAL DRAWING OF SCREWED REFLUX VALVE TO BE USED IN SUCTION LINE OF AGRICULTURAL PUMP

FIG. 2B TYPICAL SECTIONAL DRAWING OF FLANGED REFLUX VALVE TO BE USED IN SUCTION LINE OF AGRICULTURAL PUMP
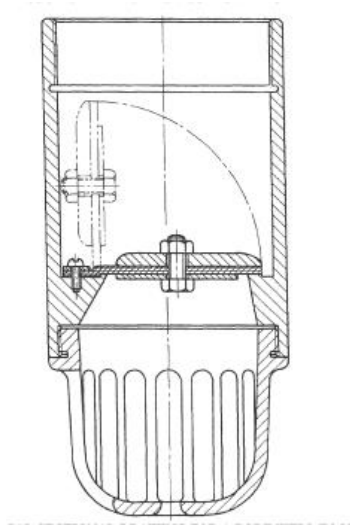
FIG. 3 TYPICAL SECTIONAL DRAWING FOR A BORE WELL FOOT-VALVE

4.2 Besides these materials, plastics like rigid PVC, highdensity polyethylene, and polypropylene are also suitable materials formanufacture of foot-valves, reflux valves, and bore valves.

5 REQUIREMENTS

5.1 The friction loss in a foot-valve, reflux valve, or bore valve shall be defined as:

$$hf = \frac{KV^2}{2g}$$

where

h_f = frictional losses in the valve (meters of water column),

K = friction coefficient of the valve,

V = velocity of flow of water in the suction or bore pipe of diameter corresponding to the nominal size of valve (m/s), and

g = acceleration due to gravity(m/s^2).

5.1.1 The design of foot-valves and reflux valves shall be such that the K-value shall not exceed the value given below in the entire range of discharge indicated in Table 2.

Sl No.	Valve Type	K-value
(1)	(2)	(3)
i)	Foot valve	0.8
ii)	Reflux valve	0.5
iii)	Bore valve with strainer	1.4
iv)	Bore valve without strainer	1.2

5.1.2 The K value for the bore valve shall be as given in **5.1.1**.

5.1.2.1 Range of discharge shall be as given in Table 2.

4

Table 2 Range of Discharge for Different Sizes of Valves

(*Clauses* 5.1.1, 5.1.2.1 *and* 7.2.1)

Sl No.	Nominal Size of Valve	Range of Discharge
	In *mm*	l/s
(1)	(2)	(3)
i)	25	0.3 to 2.2
ii)	32	1.2 to 3.5
iii)	40	1.5 to 5
iv)	50	3 to 7
v)	65	5 to 12
vi)	80	8 to 20
vii)	100	16 to 32
viii)	125	25 to 53
ix)	150	40 to 84

5.2 Screwed Ends

The ends shall have internal threads conforming to IS 554.

5.3 The dimensions of flanges and diameter of bolt holes shall be as given in Table 3 unless otherwise required for export.

> NOTE — considering that a large number of flanges are being manufactured having PCD and outer dia D at variance with those given in Table 3, these dimensions may also be as agreed between manufacturer and purchaser. However, efforts should be made to switch over to dimensions given in Table 3 to facilitate interchangeability.

6 COATING

6.1 Two coats of black japan conforming to Type B of IS 341 or paint conforming to IS 158 shall be applied.

7 TESTING

7.1 Tests

7.1.1 *Seat Test*

Each valve shall be held in an upright position and the seat shall be subjected to a maximum hydrostatic test pressure of 0.02 MPa for 2 minutes during which period there shall be no leakage. Alternatively, column pipe of a maximum 2 meter length may be used for this test.

7.1.2 *Housing Test*

Each valve shall be held in an upright position and the case part shall be subjected to a hydrostatic pressure of 0.5 MPa for 2 minutes. There shall be neither any leakage nor permanent distortion of any of the component parts.

7.2 K-Value Test for Foot-Valves and Bore Valves

7.2.1 The testing set up for determining of K-value of foot valves and bore valves is given in Fig. 4. The water level shall be at or about the tapping connection of the manometer during the test. In case the water level is above the manometer tapping, the height of the water level above manometer tapping (X) shall not exceed 0.1 m. The discharge valve shall be operated from fully close to fully open position to vary the discharge rate (Q), the manometer reading (h_m), and the height of water level above manometer tapping (X) shall be recorded. Five observations shall be taken covering the discharge range specified in Table 2, for the valve under test. The value for h_{ml} for each observation, shall be computed as given below:

$$h_{ml} = h_m + X \ldots\ldots\ldots\ldots(1)$$

where

h_m = manometer reading, and

X = height of water level above manometer tapping.

Graph Q versus h_{ml} shall be plotted. The actual inside diameter of the suction pipe used for testing shall be recorded.

The value of K can be worked out for any discharge rate as below:

$$h_{ml} = h_f + h_{fl} + \frac{V_p^2}{2g} \quad \ldots\ldots\ldots\ldots (2)$$

where

$h_{ml} = h_m + X$

h_f = friction losses in foot valve

$= K\dfrac{Vn^2}{2g}$

h_{fl} = friction losses in $4d$ length of pipe (that is, pipe length between foot valve and manometer tapping),

V_p = velocity in suction pipe corresponding to actual pipe size used for testing in m/s, and
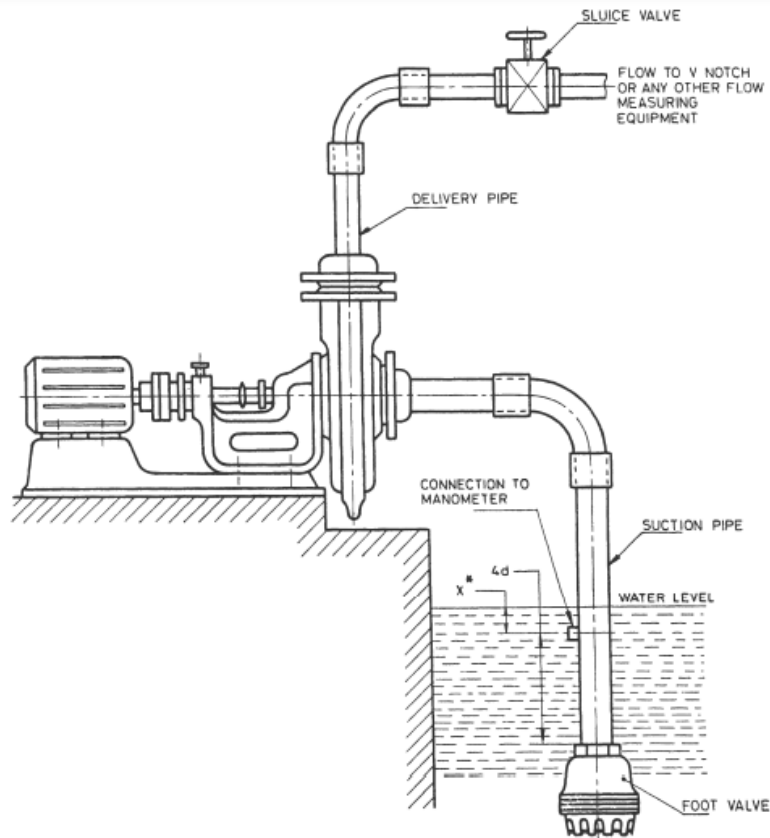
h_{fl} = works outto approximately $0.1\dfrac{Vp^2}{2g}$ for GI pipe.

Hence equation (2) can be put as:

$$h_{ml} = h_f + 1.1\frac{Vp^2}{2g}\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

Compute h_f from equation (3)

$$h_f = K\frac{Vn^2}{2g}\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

d = Inside pipe diameter.

Value of X shall not exceed 0.1 m.

FIG. 4 SET UP FOR EVALUATING VALUE OF 'K' OF FOOT-VALVE OR BORE VALVE

The value of K can be derived from equation (4).

Example:

To work out the value of K for a 100 mm foot valve. From observation

Discharge rate, Q = 25 l/s

Manometer reading h_m = 0.7 m of the water column

Height of water level above manometer tapping X = 0.1 m

$h_{ml} = h_m + X = 0.7 + 0.1 = 0.8$ m

Actual inside dia of pipe used for testing = 104 mm

Then,

$$\frac{Vp^2}{2g} = 0.442m$$

$$h_{ml} = h_f + 1.1 \times \frac{Vp^2}{2g}$$

$0.8 = h_f + 1.1 \times 0.442$

For 100 mm pipe at Q = 25 l/s

$$\frac{Vn^2}{2g} = 0.517m$$

$$h_{f=}K\frac{Vn^2}{2g}$$

$$0.314 = K \times 0.517$$

$$K = 0.6.7$$

7.2.2 *K-value Tests for Reflux Valves*

The testing set up for the determination of K-values of reflux valves shall be as shown in Fig. 5. Water level shall always be maintained below the lower tapping of

the manometer. The test procedure shall be similar to that prescribed in **7.2.1** with the following modifications:

a) There shall be tapings on pipes connected to both the ends of foot-valves at a distance of $4d$ above and below the valve.

b) The pressure difference between those tapings in the pipes connected to the valve shall be measured at different rates of discharge in the prescribed range. They shall indicate h_f in valve + pipe sections.

c) The h_f in the reflux valve shall be computed as follows:

$$hm = h + hf + 0.2\frac{Vp^2}{2g}$$

Where

h_m = manometer reading,

$0.2\frac{Vp^2}{2g}$ = friction losses in $8d$ length of pipe,

h_f = friction losses in reflux valve, in meter.

7.2.3 Alternate manometer arrangements for testing 'K' factor for reflux valves

7.2.3.1 Single differential manometer as shown in Fig. 6 or two differential manometers as shown in Fig. 7 may be used. It shall be ensured that there is no water column into the limbs of the manometers. To avoid entry of water in manometer limbs always test the valve from low discharge rate towards high discharge rate. For these manometer

arrangements h_f in reflux valve shall be computed as follows:

$$h_m = h + h_f + 0.2 \frac{V p^2}{2g}$$

where

h_m = manometer reading,

$0.2\frac{V p2}{2g}$ = frictional losses in $8d$ length of pipe,

V_p = velocity in suction pipe corresponding to actual pipe size used for testing (m/s), and

h_f = frictional losses in reflux valve in mwc (meter).

7.2.3.2 Inverted U-tube manometer arrangement may be used as shown in Fig. 8.

The following procedure shall be followed while using this arrangement:

a) Keep the cock position so as **1** and **2** are connected.

b) Prime the pump by filling the water.

c) After priming, cock position to be shifted to connect **2** and **3** to release the compressed air in the tube connected to the suction of the pump.

d) In case the pump is primed by a vacuum pump, keep the cock closed from all three positions and then prime the pump. After priming, cock position as per **a)**

and **c)** to be kept simultaneously to release air in the tubes.

e) Close the cock from all three positions and start the pump.

f) Open the cock to connect **1** and **3**. As the cock is opened the pump suction will cause water to rise in the limbs.

g) When the water level in one limb is visible slightly, close the cock and stop the same when the water level in the second limb also becomes visible.

h) The height difference between the levels of water in the two limbs shall the value of h_m in mwc (meter).

A manometer of 1.5 m height may be sufficient for most of the valves.

For this arrangement friction losses in the reflux valve shall be computed as follows:
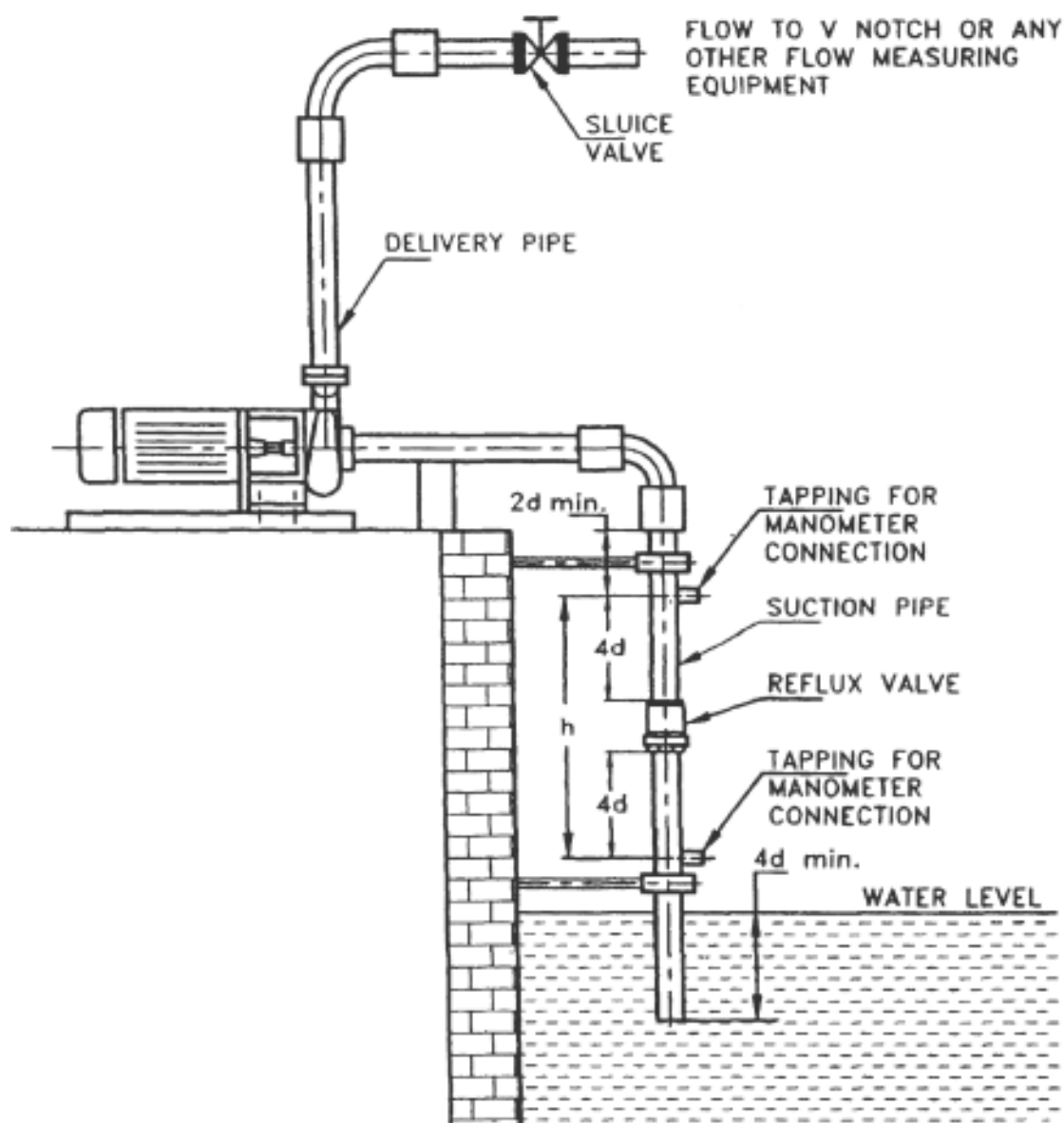
$$h_m = h_f + 0.2 \frac{V p^2}{2g}$$

In this arrangement, h will not appear in the formula.

7.2.4 Friction of coefficient K at different flow rates shall be computed as follows:

$$h_f = K \frac{V n^2}{2g}$$

where

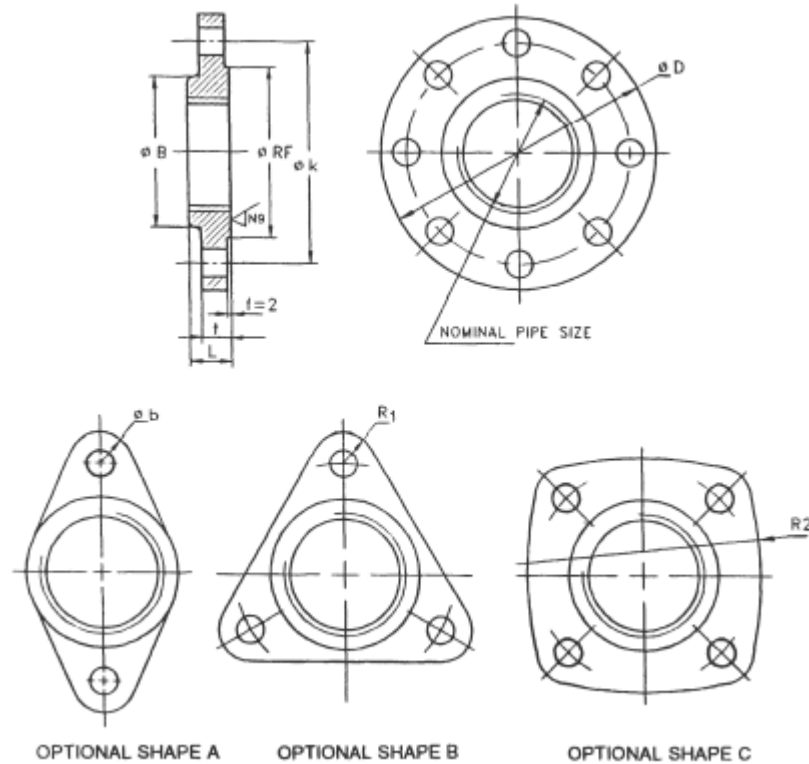V_n = Velocity of the flow of water corresponding to a nominal size of valve (m/s).

8

d = Inside pipe diameter.

NOTE— Refer to Fig. 6 and 7 for alternate manometer arrangements.

FIG. 5 TEST SET-UP FOR EVALUATING VALUE OF *K* OF REFLUX VALVE

Table 3 Dimensions of Flanges

(*Clause* 5.3)

All dimensions in millimeters

| Sl No.	Nominal Pipe Size	Nominal Hub Dia B	Nominal Bolt Size	Bolt Nos Off	Dia of Bolt Holes b	PCD k (± 1)	Nominal Raised Face Dia RF	Flange Thickness t, Min	Thread Length L, Min	Outer Dia D (± 3)	Optional Shape		
											Type	R_1	R_2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
i)	25	46	M 10	2	12	75	60	9	12	100	A	12	-
ii)	32	55	M 10	2	12	85	70	9	12	110	A	12	-
iii)	40	60	M 10	4	12	95	80	9	12	120	C	12	129
iv)	50	71	M 12	4	15	110	95	9	15	140	C	14	168
v)	65	87	M 12	4	15	125	110	11	20	155	C	14	212
vi)	80	100	M 12	4	15	140	120	13	22	170	C	14	262
vii)	100	130	M 12	4	15	170	145	16	26	200	C	14	378
viii)	125	156	M 16	4	19	200	175	16	26	235	-	-	-
ix)	150	184	M 16	8	19	225	200	16	26	260	-	-	-
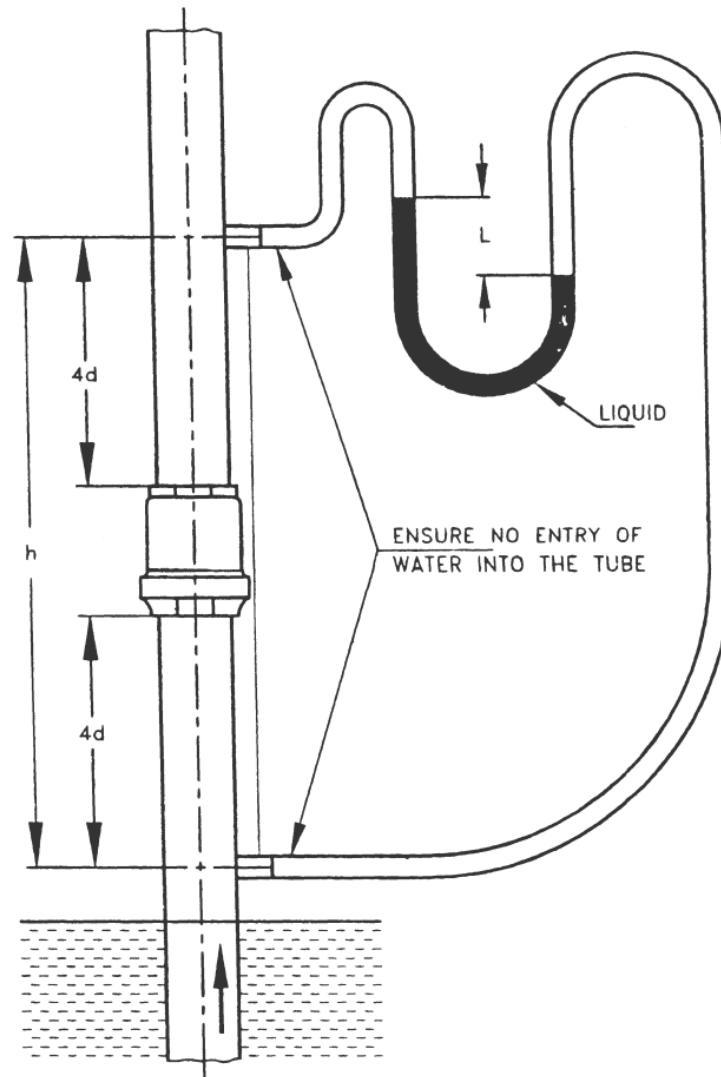
$$h_{\mathrm{m}} = L \times W$$

W = Specific weight of the liquid.

The h_f in Reflux Valve shall be computed as follows:

$$h_m = h + h_f + 0.2\,\frac{Vp^2}{2g}$$

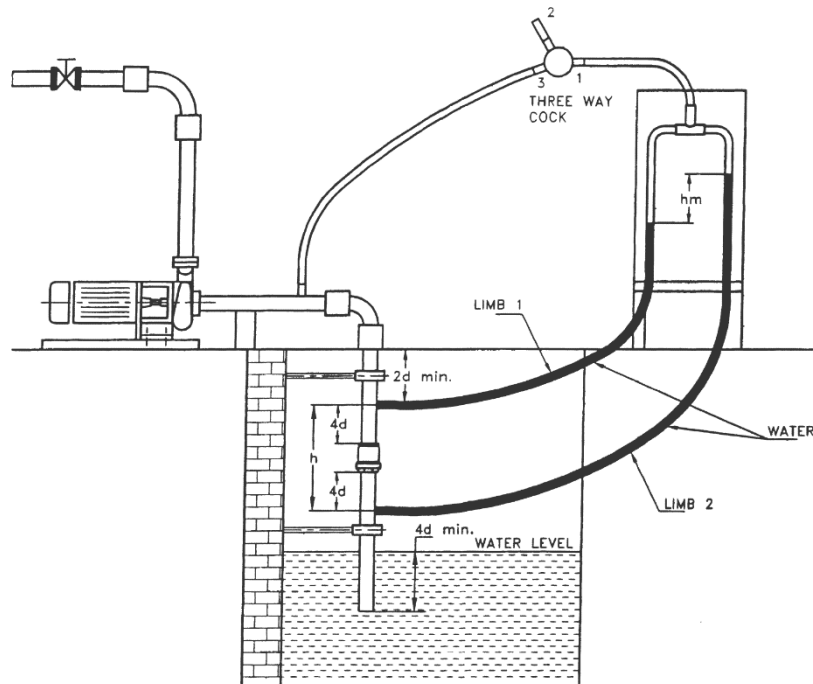FIG. 6 TYPICAL TESTING ARRANGEMENT WITH SINGLE DIFFERENTIAL MANOMETER
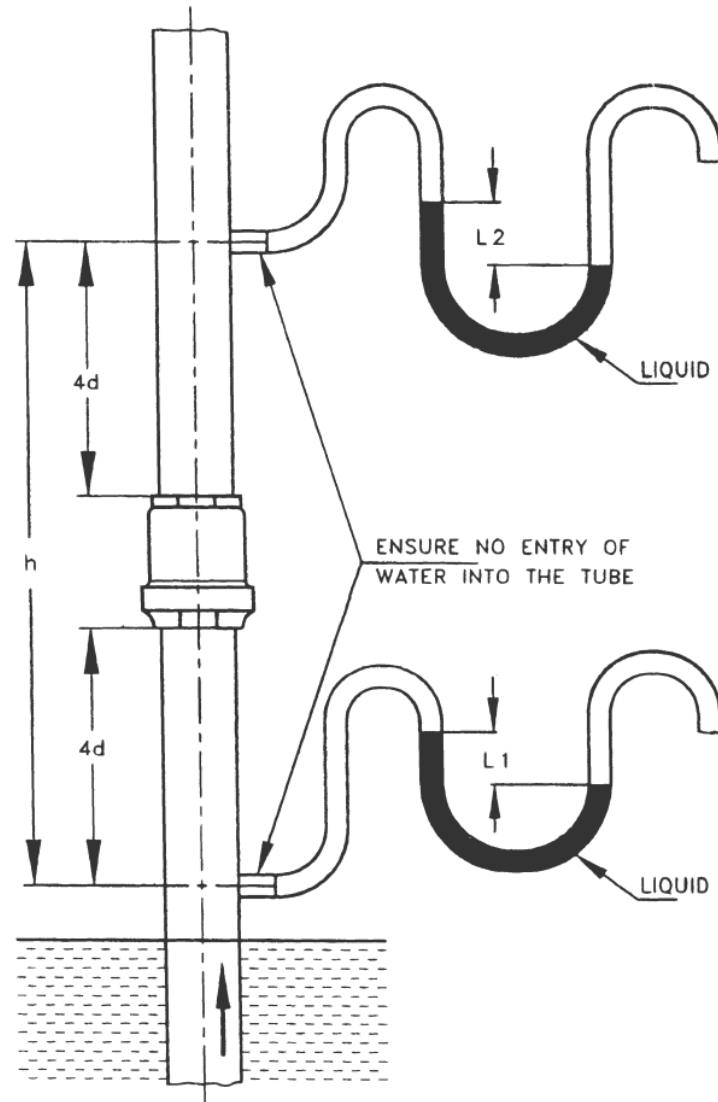
$$h_m = (L_2 - L_1) \times W$$

W=Specific weight of the liquid.

The h_f in Reflux Valve shall be computed as follows:

$$h_m = h + h_f + 0.2 \frac{Vp^2}{2g}$$

Fig. 7 Typical Testing Arrangement with Two Differential Manometers

The h_f in Reflux Valve shall be computed as follows

$$h_m = h_f + 0.2 \frac{Vp^2}{2g}$$

FIG. 8 TYPICAL TESTING ARRANGEMENT WITH INVERTED U-TUBE MANOMETER

8 SAMPLING

One valve out of a lot of 50 to 500 valves of the same size and type shall be randomly picked up for the h_f test. The K-values shall be computed from test data. If the K-value exceeds the prescribed limit at any rate of discharge in a specific range for that size, the whole lot shall be rejected.

9 MARKING

Every valve shall have a cast-mark giving the following information:

a) Manufacturer's name or trade-mark, and

b) Size of the valve.

9.1 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards* Act, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
IS 158 : 2015	Ready mixed paint, brushing, bituminous, black, acid, alkali and heat resisting ― Specification (*fourth revision*)
IS 210 : 2009	Specification for grey iron castings (*fifth revision*)
IS 341 : 2016	Specification for Black Japan, Types A, B and C (*second revision*)
IS 554 : 1999	Dimensions for pipe threads where pressure tight joints are required on the threads (*fourth revision*)
IS 5986 : 2017	Hot rolled steel sheet, plate and strip for forming and flanging purposes ― Specification (*fourth revision*)

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Pumps Sectional Committee, MED 20

Organization(s)	*Representative(s)*
Thyssenkrupp Industrial Solutions (India) Pvt Limited, Mumbai	SHRI A.K. NIJHAWAN (***Chairman***)
AQUASUB Engineering, Coimbatore	SHRI C. MURUGESAN (*Alternate*)
Best Engineers Pumps Pvt Limited, Coimbatore	SHRIMATI C. G. SRIPRIYA SHRI T. PARTHIBAN (*Alternate*)
Bharat Heavy Electrical Limited, New Delhi	SHRI ANUJ JAIN SHRI HARDEEP SINGH DOGRA (*Alternate*)
Bharat Petroleum Corporation Limited , Mumbai	SHRI D. P. CHANDRAMORE SHRI SANTOSH N KALE (*Alternate*)
Bureau of Energy Efficiency, New Delhi	SHRI SAMEER PANDITA SHRI KAMRAN SHAIKH (*Alternate*)
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Chief Quality Assurance Establishment, Ministry of Defence, New Delhi	SHRI G. ARAVINDAM
Crompton Greaves Consumer Electricals Limited, Ahmednagar	SHRI PARVINGARJE SHRI PARVINMURDEKAR (*Alternate I*) SHRI ROHITKANASE (*YOUNG PROFESSIONAL*) (*Alternate II*)
Delhi Jal Board, New Delhi	SHRI PRAVEEN BHARGAVA
Directorate General of Quality Assurance, Ministry of Defence, New Delhi	SHRI R.V. JAIN
Electrical Research and Development Association (ERDA), Vadodara	SHRI RAVI PRAKASH SINGH SHRI GAUTAM BRAHMBHATT (*Alternate*)

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	Shri Dinesh Bhatia (*Alternate*)
GAIL (India) Limited, New Delhi	Shri Satish Geda
Grundfos Pumps India Pvt Limited, Chennai	Shri Bibek Saha
Havells India Limited, Noida	Shri Anil Sukumar Akole
Hindustan Petroleum Corporation Limited, Mumbai	Shri Arijit Sanyal
Indian Pump Manufacturers Association, Ahemdabad	Shri Utkarsh A. Chhaya
International Copper Association India, Mumbai	Shri Mayur Karmakar
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KSB Pumps Limited, Pune	Shri Uday Joshi
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Kirloskar Brothers Limited, Pune	Shri RavindraBirajdar
	Shri Vasant Godbole (*Alternate*)
Kirloskar Ebara Pumps Limited, Pune	Shri A. S. Joshi
Mangalore Refinery and Petrochemicals Limited, Mangalore	Shri Adarsh G. A.
	Shri P Rajendran (*Alternate*)
Mecon Limited, Ranchi	Shri P. S. Rao
	Shri A. Gangal (*Alternate*)
National Bank for Agriculture and Rural Development, Mumbai	Shri D. Elangovan
	Shri A.K. Sinha (*Alternate*)
North India Pump Manufacture Association, Phagwara	Shri C. L. Garg
	Shri SurienderKalsi (*Alternate*)
Petroleum Conservation Research Association, New Delhi	Shri A. K. Goel
	Dr. Abhay Sharma (*Alternate*)
Projects and Development India Limited, Vadodara	Shri A. K. Gupta
	Shri D. K. Vohra (*Alternate*)

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Organization(s)	*Representative(s)*
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	SHRI D.R. SHAH (*Alternate*)
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BIS Directorate General	SHRI RAJNEESH KHOSLA Scientist 'E' and Head (MED)
	[Representing Director General (Ex-officio)]

Member Secretary
SHRI AMAN DHANAWAT
Scientist 'B' (MED), BIS

Agricultural and Domestic Pumps Subcommittee, 20:5

Organization(s)	*Representative(s)*
The Southern India Engineering Manufacturer's Association, Coimbatore	SHRI G. RAJENDRAN (***Convenor***)
Agrofab Machineries India Pvt Limited, Jaipur	SHRI ALOK GUPTA SHRI SIDDHARTH GUPTA (*Alternate*)
Aquasub Engineering, Coimbatore	DR C. MUTHU SHRI C. MURUGESASN (*Alternate*)
Best Engineers Pumps India Private Limited, Coimbatore	SHRI S. THANGAPANDI SHRI N. RANADHIVE (*Alternate*)
CSIR-Central Mechanical Engineering Research Institute, Durgapur	SHRI SUBRATA KUMAR MANDAL SHRI ASHOK KUMAR PRASAD (*Alternate*)
Central Equipment and Stores Procurement, Lucknow	SHRI ARUN KUMAR SHRI M. P. KANDOOI (*Alternate*)
Central Ground Water Board, Nagpur	SHRI G. D. OJHA SHRI ASHIS CHAKRABORTY (*Alternate*)
Crompton Greaves Consumer Electricals Limited, Ahmednagar	SHRI PARVINGARJE SHRI PARVINMURDEKAR (*Alternate*) SHRI ROHITKANASE (*Young Professional*)
Havells India Limited, Noida	SHRI ANIL SUKUMARAKOLE SHRI MANISH KUMAR VIMAL (*Alternate*)
Indian pump Manufacturers Association, Ahemdabad	SHRI YOGESHMISTRI SHRI UTKARSH A. CHHAYA (*Alternate*)
KSB Pumps Limited, Pune	SHRI ABHAY A. VIRKAR SHRI SANJEEV CHOUDHARY (*Alternate*)
Kalsi Metal Works, Jalandhar	SHRI BARINDER KALSI SHRI PUNEET KALSI (*Alternate*) SHRI K. R. KOHLI (*Alternate II*)
Kirloskar Brothers Limited, Pune	SHRI RAVINDRABIRAJDAR SHRI SUDHIR MALI (*Alternate*)

Organization(s)	*Representative(s)*
North India Pump Manufacture Association, Jalandhar	SHRI C.L. GARG
	SHRI JATINKALSI (*Alternate*)
Punjab Agricultural University, Ludhiana	DR SUNIL GARG (*Alternate*)
Rajkot Engineering Association, Rajkot	SHRI ANANDSAVALIYA
	SHRI D.R. SHAH (*Alternate*)
Roxon Industries, Amritsar	SHRI KIRPAL SINGH
Scientific and Industrial Testing and Research Centre, Coimbatore	SHRI A. M. SELVARAJ
UL India Private Limited, Bengaluru	SHRI V. MANJUNATH
In Personal Capacity, Mumbai	SHRI S. L. ABHYANKAR
In Personal Capacity, Ludhiana	DR A. K. JAIN

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected